

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

**EP 0 710 074 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
15.01.1997 Bulletin 1997/03

(51) Int. Cl.<sup>6</sup>: **A23G 9/02**, **A23G 9/24**,  
**A23G 9/26**

(21) Application number: **95908256.1**

(86) International application number:  
**PCT/EP95/00384**

(22) Date of filing: **01.02.1995**

(87) International publication number:  
**WO 95/20883 (10.08.1995 Gazette 1995/34)**

**(54) ICE CONFECTIONS**

**SPEISEEIS**

**CONFISERIE GLACEE**

(84) Designated Contracting States:  
**AT BE CH DE DK ES FR GB GR IE IT LI NL PT SE**

(30) Priority: **04.02.1994 EP 94300821**

(43) Date of publication of application:  
**08.05.1996 Bulletin 1996/19**

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**BE CH DE DK ES FR GR IT LI NL PT SE AT**

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**EP-A- 0 500 940** **US-A- 2 360 559**  
**US-A- 4 548 045**

Remarks:

The file contains technical information submitted  
after the application was filed and not included in  
this specification

**EP 0 710 074 B1**

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## Description

### FIELD OF THE INVENTION

This invention relates to ice confections which comprise a mass of a milk containing frozen confection, for example ice cream, with a surface covering of water ice. Products of this form are usually referred to as "splits" and this term will be used. This product form provides two refreshing ice compositions within a single body.

### BACKGROUND TO THE INVENTION

Splits are usually sold with an ice cream core, as an example of a milk based frozen confection, with a stick for holding the product and an outer layer of water ice. However, they are not limited to this geometry and may be in other shapes, e.g. spherical, and can be in a container for consumption. For example an ice cream could be produced in a standard tub with a layer of water ice on top. The term "split" is used herein to be a mass of ice confection having a layer of water ice in contact with it.

The milk containing frozen confection contains milk proteins and the class includes ice cream, frozen yoghurt, sherbet, sorbet, ice milk and frozen custards. The usual form of protein will be animal milk but vegetable sources, e.g. soya milk, are also usable. There is no criticality in the source of the milk protein and it may be incorporated as liquid milk, cream, skimmed milk, milk powder and skimmed milk powder, as examples.

One known method of manufacturing split products is to partially freeze a water ice composition in the form of a cylinder closed at one end and then fill the centre core with liquid ice cream composition. Typically the water ice solution is placed in a cone in a freezing bath. The cone is inverted when the water ice contacting the cone wall is frozen and then an ice confection placed in the core. A stick for hand holding is placed in the core.

The manufacture of a two component ice confection by this route requires careful manipulation of the feedstocks and the several stages of handling. There is usually a restriction in the product geometry which can be obtained. The levels of overrun in the ice confection are limited because at higher levels the ice confection is more viscous.

### LITERATURE

Ice confections have been well characterised in the literature and general disclosures will be found in "Ice Cream" by W S Arbuckle (published by AVI of Westport, Conn USA) in 4 editions and J Soc Dairy Technology 1990, 43(1), pp 17-20.

US 4 548 045 discloses a process for the manufacture of pop-shaped frozen confections. A mould is filled with a flowable confection, this is then partially frozen, and a stick inserted. A liquid cryogen is then dosed into the top of the mould to freeze completely the confection.

The frozen confection is then de-moulded and may be dipped in a water bath to form an encapsulating ice shell in order to prevent dehydration of the product on storage.

### GENERAL DESCRIPTION OF THE INVENTION

The invention provides a method of preparing a two component ice confection in which (i) a surface of a mass of milk containing ice confection is brought to a temperature of below about  $-15^{\circ}\text{C}$ , preferably below about  $-25^{\circ}\text{C}$  and more preferably below about  $-40^{\circ}\text{C}$ , (ii) the surface is contacted with a water ice solution having a solids content between about 15% and about 50% by weight for a time sufficient to allow a layer of water ice to form on the surface and (iii) the whole is subjected to a hardening step to form the water ice layer. This step is performed at the temperature of step (i) or preferably below. Water ice forms during the pick up but the layer is completed in the hardening step.

Preferably the two component ice confection formed by this process comprises a mass of milk containing ice confection having a water ice on at least one surface having an average ice crystal size ( $D_{(3,0)}$ ) below 100 micron more preferably below 80 micron. This method provides a water ice layer which has consistent texture and can have a range of thickness. The low temperature of the ice confection core can be obtained in a refrigerated volume, for example a blast cooler, or preferably by immersion in a cryogenic liquid, e.g. liquid nitrogen.

The product of this invention comprises two essential components, the ice confection mass and the water ice layer. Additional optional components may be present, examples are syrup, nuts, chocolate pieces and fruit pieces.

The amount of water ice solution picked up after immersion is determined by the temperature of the ice confection core, while the ice crystal size is determined predominantly by the temperature of the hardening step. Thus, if the core was at  $-15^{\circ}\text{C}$  prior to immersion and the hardening step (iii) was obtained by immersion in liquid nitrogen then the water ice will have the desirable size of ice crystals but only a thin layer will be present. Hardening the product at  $-15^{\circ}\text{C}$  provides a thin layer with relatively large crystals. Similarly, a core cooled in liquid nitrogen but hardened at  $-15^{\circ}\text{C}$  will give relatively large amount of pick-up but a water ice with relatively large crystals.

The water ice component may contain low amounts of a fat containing material, e.g. milk, provided its presence does not interfere with the water crystallisation. The water ice maybe aerated.

The preferred average ice crystal size  $D_{(3,0)}$  of 80 micron is generally obtained by using liquid nitrogen or other cryogenic liquid for both steps (i) and (iii). Using temperatures of about  $-40^{\circ}\text{C}$ , provided for example by a blast freezer tunnel, in both steps (i) and (iii) provides a water ice layer with ice crystals having a  $D_{(3,0)}$  of below

100 microns.

Consumer tests have shown the presence of water ice crystals below about 80 microns provide a particularly soft texture.

The method of the invention uses process steps which are easy to operate sequentially and uses apparatus and cooling materials which are either in wide use or are available commercially and are easily handled.

The surface of the milk containing ice confection is preferably brought to the desired low temperature by immersing it in liquid nitrogen or other liquified gas at low temperature, or contacting the desired surface with a heat exchanging surface cooled to an appropriate low temperature, for example with an innocuous liquid refrigerant such as liquid nitrogen or a solid refrigerant such as carbon dioxide.

In another method successive layers of water ice can be laid down on the surface of the mass of milk containing ice confection by immersing the mass in water ice solution and then in a suitable cryogenic liquid or in a refrigerated volume at low temperature to make another layer of water ice. These stages can be repeated to build up a thicker layer of water ice.

The preferred viscosity of the water ice solution is up to 5 poise to provide optimum generation of the water ice layer. A 0.2% w/w aqueous solution of locust bean gum (LBG) has a viscosity of about 1 poise.

It is not necessary for the second cooling stage to be at the same temperature as the stage cooling the core. Thus, dependent on the apparatus available and desired product properties, it may be at a higher or lower temperature.

The ice confection core can be subjected to a moulding stage prior to immersion in the water ice solution. With suitable design and thickness of water ice layer the final product will exhibit the moulding. The ice confection may contain fruit pieces, nuts and syrup, as examples of other optional components. Usually the confection will include a stick penetrating the core to allow it to be held in the hand.

The relatively small ice crystal size and orientation of the water ice and selection of the total solids provides a soft texture to the water ice when bitten. The texture of the milk protein containing ice confection is also very good because it is formed as the core by standard processing steps. There is no restriction or overrun which will usually be in the range from 50% to 150%. Additionally, the use of standard processes allows the usual components, e.g. fats to be present at the usual levels. Thus there is no restriction on the ice confection caused by viscosity requirements to allow feed into a quiescently formed water ice shell. A product formed by the quiescent process will have larger ice crystals, for example some in the order of millimetres. In general quiescently frozen products have dendritic ice crystals, while those produced according to the present invention have a more rounded shape comparable to those obtained in a freezer barrel. A complete quiescently formed split was found to be harder to bite, crunchier

and less chewy. The water ice layer was less adhesive to the core.

A solids level of below about 15% in the water ice will give only a small amount of structuring and flavour while about 50% the solids content provide a very soft water ice layer.

Slushes, i.e. water ice solutions containing ice crystals, are usable in the invention to provide a roughened water ice layer. These ice crystals may include a gas clathrate, for example as described in EP 0201143. The ice crystals formed by the process of the present invention provide a soft texture.

#### Test methods

Ice crystal size: a thin water ice sample was examined using a cold stage (-20°C) microscope in a white spirit matrix. Polarising filters were used at x100 magnification to obtain maximum contrast and a Zeiss particle size analyzer used to obtain the average ice crystal size as  $D_{(3,0)}$ .

#### SPECIFIC DESCRIPTION OF THE INVENTION

Examples of the invention will now be given to illustrate the invention.

#### Example I

An ice cream formulation with the following composition was prepared using standard techniques.

Ingredient	Weight %
skimmed milk powder	10.0
sugars	17.2
butter	10.5
flavour	0.1
water	61.5
emulsifier	0.4
stabiliser	0.25

The ice cream was prepared with an overrun of 100%, extruded through a shaped nozzle to give a cylinder of 56g and the stick inserted. It was then hardened in a freezing tunnel at -40°C. After leaving the tunnel the portions were dipped in liquid nitrogen for 8 seconds and then in a water ice solution at 5°C, which is the usual temperature of storage, for 15 seconds. This solution had a composition of:

Ingredient	Weight %
sugars	21.5
stabiliser (LBG)	0.4
fruit solids	4.4
citric acid	0.2
colour	0.2
water	remainder

The excess water ice solution was allowed to drip off and then the portions were immersed in liquid nitrogen to harden the external surface and complete the formation of the water ice layer. The product contained 25g water ice in the external layer.

The products were then stored at about -30°C in a cold store before distribution. The particle size distribution ( $D_{(3,0)}$ ) in the water ice layer immediately after preparation was about 55 micron; this increased to about 75 microns on storage during distribution.

#### Example II

Samples of the ice cream core prepared as in Example I were cooled to temperatures of -15°C, -25°C, -30°C and -40°C in a refrigerated volume. They were then immersed in the Example I water ice solution for 10 seconds and the products hardened at the above temperatures.

The results are shown in Table I with the Example I results included for comparison. It is seen the amount of water ice reduces as the core temperature rises. Increased amounts of water ice can be picked up by using more cycles of cooling/immersion.

Table I

Temperature of core °C	Hardening Temp °C	Weight of water ice (g)
Liq N <sub>2</sub> *	Liq N <sub>2</sub> *	25
-40	-40	18 (A)
-30	-30	14
-25	-25	13
-15	-15	8 (B)

\* 8 seconds exposure

The products (A) using -40°C for the core temperature and hardening stage had a  $D_{(3,0)}$  of 85 microns, while the products (B) using -15°C for the core temper-

ature and hardening stage had a  $D_{(3,0)}$  of above 200 microns.

#### Claims

1. A method of preparing a two-component ice confection in which:

i) a surface of a mass of milk containing ice confection is brought to a temperature of below about -15°C,

ii) the surface is immersed in a water ice solution having a solids content between 15% and 50% by weight for a time sufficient to allow a layer of water ice to form on the surface, and

iii) the whole is subjected to a hardening step to form the water ice layer, whereby the whole is cooled to the temperature of step (i) or below.

2. A method according to claim 1 wherein the temperature in step (i) is below -25°C.

3. A method according to claim 1 or 2 wherein the temperature in step (i) is below -40°C.

4. A method according to any preceding claim in which steps (ii) & (iii) are repeated to build up successive layers of water ice.

5. A method according to any preceding claim wherein the cooling process in step (i) is obtained by immersion in a cryogenic liquid.

6. A method according to any preceding claim wherein the cooling process in step (iii) is obtained by immersion in a cryogenic liquid.

7. A method according to any preceding claim wherein the mass of milk containing ice confection is prepared by extrusion.

8. A method according to any preceding claim wherein any excess water ice solution following immersion in step (ii) is allowed to drip off before the hardening step (iii).

#### Patentansprüche

1. Verfahren zur Herstellung eines Zweikomponenten-Eiskonfekts, bei welchem:

i) eine Oberfläche einer Masse an milchhaltigem Eiskonfekt auf eine Temperatur von weniger als etwa -15°C gebracht wird,

ii) die Oberfläche in eine Wassereis-Lösung mit einem Feststoff-Gehalt zwischen 15 Masse-% und 50 Masse-% während einer ausreichen-

- den Zeit eingetaucht wird, um eine Wassereis-Schicht an der Oberfläche bilden zu lassen, und
- iii) das Ganze einem Härtungsschritt unterworfen wird, um die Wassereis-Schicht zu bilden, wodurch das Ganze auf die Temperatur von Schritt (i) oder weniger gekühlt wird. 5
2. Verfahren nach Anspruch 1, bei welchem die Temperatur in Schritt (i) weniger als -25°C beträgt. 10
  3. Verfahren nach Anspruch 1 oder 2, bei welchem die Temperatur in Schritt (i) weniger als -40°C beträgt.
  4. Verfahren nach einem der vorhergehenden Ansprüche, bei welchem die Schritte (ii) und (iii) wiederholt werden, um aufeinanderfolgenden Wassereis-Schichten zu bilden. 15
  5. Verfahren nach einem der vorhergehenden Ansprüche, bei welchem der Kühlprozeß in Schritt (i) durch Eintauchen in eine kryogene Flüssigkeit erhalten wird. 20
  6. Verfahren nach einem der vorhergehenden Ansprüche, bei welchem der Kühlprozeß in Schritt (iii) durch Eintauchen in eine kryogene Flüssigkeit erhalten wird. 25
  7. Verfahren nach einem der vorhergehenden Ansprüche, bei welchem die Masse an milchhaltigem Eiskonfekt durch Extrusion hergestellt wird. 30
  8. Verfahren nach einem der vorhergehenden Ansprüche, bei welchem jegliche überschüssige Wassereis-Lösung nach dem Eintauchen in Schritt (ii) vor dem Härtungsschritt (iii) abtropfen gelassen wird. 35
- laquelle la température de l'étape (i) est inférieure à -25 ° C.
3. Une méthode selon la Revendication 1 ou 2, dans laquelle la température de l'étape (i) est inférieure à -40 ° C.
  4. Une méthode selon l'une quelconque des Revendications précédentes, dans laquelle les étapes (ii) et (iii) sont répétées de façon à constituer des couches successives de glace.
  5. Une méthode selon l'une quelconque des Revendications précédentes, dans laquelle le procédé de refroidissement de l'étape (i) est réalisé par immersion dans un liquide cryogène.
  6. Une méthode selon l'une quelconque des Revendications précédentes, dans laquelle le procédé de refroidissement de l'étape (iii) est réalisé par immersion dans un liquide cryogène
  7. Une méthode selon l'une quelconque des Revendications précédentes, dans laquelle la masse constituée de confiserie glacée à base de lait est préparée par extrusion.
  8. Une méthode selon l'une quelconque des Revendications précédentes, dans laquelle on laisse s'égoutter tout excès de solution de glace consécutivement à l'immersion de l'étape (ii) avant de procéder à l'étape de durcissement (iii).

#### Revendications

1. Une méthode de préparation d'une confiserie glacée à deux composants dans laquelle : 40
  - (i) une surface d'une masse de confiserie glacée à base de lait est amenée à une température inférieure à environ -15 ° C, 45
  - (ii) la surface est immergée dans une solution de glace présentant une teneur en solides comprise entre 15 % et 50 % en masse pendant une durée suffisante pour permettre à une couche de glace de se former en surface, et 50
  - (iii) l'ensemble étant soumis à une étape de durcissement afin de former la couche de glace, puis refroidi à la température de l'étape (i) ou à une température inférieure. 55
2. Une méthode selon la Revendication 1, dans